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PATENTS.

MINING, METALS, AND MINERALS—PATENT MATTERS.

BY MICHAEL HENRY,

Patent Agent and Adviser, Memb. Soc. Arts, Assoc. Soc. Eng.

Mr. FREDERICK WALTON, of the Old Hall Works, Wolverhampton, has obtained a patent for an invention relating to the construction of coal vases. According to this invention, coal vases are made of an outer metallic case and an inner metallic case, or frame, supporting a box, in which the coal is placed; this box may either be capable or incapable of removal. The front or one side of the outer case is open, and to the bottom edge thereof the inner case, or frame, is jointed. By turning the inner case, or frame, upon its joint it moves in a vertical plane, and can be turned into the outer case, so as to close the vase, or be withdrawn from the outer case, so as to open …ase. The jointed inner case, or frame, and the coal-box carried …are of such a figure that they fill up the interior of the coal vase, …pen side, or front, of the outer case being closed by the outer …of the jointed case, or frame, when the latter is raised into the …r case. The outward motion of the jointed inner case, or frame, …nited by stops. The jointed inner case, or frame, is provided …a handle, by which it can be turned out of, or into, the outer …When the inside box is made removable it is furnished with …lles, by means of which it can be removed from the jointed inner …or frame, and filled with coal, and replaced in the said case or frame. The removal of the coal vase for re-filling it is thereby rendered unnecessary. In order to obtain access to the coal vase it is only necessary to pull down the handle of the inner case. The said case is thereby turned out of the vase, and the coal carried by the removeable or fixed box is exposed. By pushing inwards the inner case the coal vase is closed. The coal shovel may either be carried by a socket outside the coal vase or by the removeable or fixed coal box. In the latter arrangement the coal box is made of a rectangular figure, the vertical sides being longer than the base, and I joint the inner case, or frame, carrying the removeable or fixed coal box at its sides instead of at its extreme bottom, as in the first-described arrangement. The inner jointed case and coal box are of less height than the outer case, so that when the former is turned into or out of the latter the coal shovel, placed in a socket at the back of the coal box, is enabled to pass without striking the top of the vase.

JOHN FAWCETT, of York, has obtained a patent for means or apparatus for measuring oil or other liquids. This invention consists in the employment of a supply cistern, which (by preference) is furnished with an ordinary ball-tap or self-acting tap for regulating the inlet thereto of the oil or other liquid, also a series of enclosed measures or vessels of any capacity, arranged, either underneath the cistern or by its side, in such manner that the oil or liquid will gravitate or flow from the said cistern into the said measure when at liberty to do so. A tap or cock suitably constructed is applied to each measure, with pipe to connect them respectively with the cistern. The plug of the said tap has an opening on one side only, and hollow thence to the end, so that when the side opening is placed to the inlet or pipe leading to the cistern the passage from thence to the measure will be open, and the oil or other liquid will flow therefrom into the said measure until full, a small air-pipe being attached to each measure rising above the top level of the oil or liquid in the cistern, and when the plug is turned, so that the side opening is placed to the outlet of the tap, the inlet will be closed, and the oil or liquid will flow from the measure until it is empty into any suitable receptacle underneath.

Mr. WILLIAM BENSON, of Hexham, has obtained a patent for an invention relating to treating or reducing ores, and apparatus employed therein. The object of this invention is the more effectually and speedily reducing ores or minerals, for the purpose of washing or separating them, either from one another or from certain of their constituents, and consists in the employment for that purpose of an arrangement of edge runners in place of stamps, which have hitherto been employed. The ores or minerals are fed to the runners by means of an upright hollow shaft, the lower portion of which is provided with lateral openings and inclined spouts, over which spouts, and through the opening in the shaft, the ores or minerals are carried by thin streams of water to the bottom of the pan or saucer, and underneath the edge rolls, by which means the ores or minerals are ground or reduced to a fine thin sludge or slime. This is afterwards carried off through openings in the side of the pan or saucer for subsequent treatment, wire-gauze being placed over the mouths of the openings to prevent the passing through of any material not sufficiently crushed, or the ores or minerals may be fed under the runners by spouts or conduits from the exterior, or through the rim of the pan or saucer. By this means a uniform and thin feed of the ores or minerals is continuously attained.

Mr. W. M'ADAM, of Glasgow, has obtained a patent for the manufacture of pottery, and machinery or apparatus employed therefor. This invention, which more especially relates to improvements in the manufacture of earthenware bottles, jars, and other articles in pottery, consists, in the first place, of certain arrangements of mechanism in which the materials of which the articles are composed are formed into shape. The mechanism consists of a horizontally revolving table, having an intermittent action, so that it stops at certain intervals, and allows time for the operations required. The table is arranged to receive moulds, in order to admit of the required number of motions to go on simultaneously. Near to the turn-table two pug-mills, or presses, are situated; from one of them pieces of clay are supplied of the exact size required for forming the article being manufactured, the quantity being determined by the capacity of a mould placed at the outlet of the mill, or press, which is filled with clay by the action of the mill, or press; and the clay passes from this into the mould in which the vessel is formed, or it may be taken direct from the pug-mill, without the use of such mould. The second pug-mill, or press, is for the purpose of forming a thick bar, or stack, of clay, which is cut off into slices, or discs, by a wire at the proper time for forming the bottom of the article to which the slices, or discs, are affixed. Previous to this invention the "white-ware," potsherds, or refuse have been a waste material, and, as the machinery hereinbefore described enables such material when ground to be utilised, the second part of the invention relates to the working of such ground refuse in combination with new clay by machinery into small articles of pottery, such as bottles.

FOREIGN MINING AND METALLURGY.

A Charleroi journal states that some attention is at last being given to the incessant complaints made to the various Belgian railway administrations upon the subject of an insufficient supply of rolling-stock. Promises are, however, one thing in this matter and performances quite another. The general state of the Belgian coal markets remains good; if a little slackening is observable in affairs it is due to the fact that many establishments take stock at this period of the year, and do not care to enter upon fresh transactions. Prices are for the rest well maintained, and a slight advance has even been accepted without opposition. Good qualities of domestic coal have been sought after. Coke has become scarce;

The Belgian metallurgical markets remain quiet, in consequence of stock-taking being now generally the order of the day, as is usually the case at the close of the year. Some transactions have been remarked which display a slightly downward tendency, but everything leads to the expectation that there will be a reaction in the direction of a rise with the commencement of the new year. This expectation appears to be logical, if we consider the high price attained by coal. We may add that the fall, which after all has been only slight, has only extended to iron in bars. Rolled-iron has made 6*l.* 16*s.* per ton, with the usual scale of different quotations per quality and per class. The exports of pig from Belgium in the first nine months of last year amounted to 11,706 tons, against 13,553 tons in the corresponding period of 1868, and 8522 tons in the corresponding period of 1867. The deliveries of Belgian pig to the Zollverein showed an increase of about 2000 tons to Sept. 30 last year, as compared with the corresponding period of 1868, but presented a decrease of about 6700 tons as compared with the corresponding period of 1867. The exports of Belgian pig to France to Sept. 30, last year, showed a diminution of 3098 tons, as compared with the corresponding period of 1868, and 4585 tons as compared with the corresponding period of 1867. The exports of rails from Belgium showed remarkable progress, having been 113,716 tons in the first nine months of 1869, against 50,759 tons in the corresponding period of 1868, and 73,453 tons in 1867. The exports of plates, which have shown a great progress since the commencement of 1869, presented especially favourable results in September, when they showed an advance of something over 33 per cent., as compared with September, 1868. The general total of the exports of plates for the first nine months of 1869 footed up to 16,429 tons, against 9788 tons in the corresponding period of 1868, and 9536 tons in the corresponding period of 1867. The exports of merchants' irons to Sept. 30 last year attained a total of 62,090 tons, in round figures, as compared with 53,000 tons in the corresponding period of 1868, and 40,000 tons in the corresponding period of 1867. The whole of the exports of pig, rails, iron, plates, and works of iron and cast-iron from Belgium presented the annexed totals for the first nine months of the last three years:—1869, 217,699 tons; 1868, 141,209 tons; and 1867, 147,536 tons. There was thus an increase in the first three quarters of last year of nearly 45 per cent., as compared with the corresponding period of 1867. In the first nine months of 1869 iron minerals were imported into Belgium to the extent of 426,648 tons, as compared with 292,035 tons in the corresponding period of 1868, and 229,908 tons in the corresponding period of 1867. Pig was imported into Belgium to Sept. 30 last year to the extent of 41,816 tons, as compared with 34,098 tons in the corresponding period of 1868, and 44,314 tons in the corresponding period of 1867. The Produits du Flénu Colliery Company commenced the payment on Monday of a dividend of 2*l.* per share for 1869. The Austro-Belgian Metallurgical Company has been paying this week a dividend on account for the exercise 1868-69, or 6*s.* per share. The United Collieries Company at Charleroi commenced the payment on Monday of "first interests" for 1869, or 12*s.* per share. A similar dividend is being paid by the North of Charleroi Collieries Company.

There is a little slackening in the iron trade in the Champagne district, in consequence of merchants being engaged in stock-taking. Rolled iron, merchants' bars, from coke-made pig is quoted at 8*l.* to 8*l.* 4*s.* per ton; mixed ditto first quality, 8*l.* 16*s.* to 9*l.* per ton; ditto second quality, 8*l.* 12*s.* per ton; ditto charcoal-made first quality, 9*l.* 4*s.* to 9*l.* 8*s.* per ton; ditto second quality, 8*l.* 16*s.* to 9*l.* per ton. Puddled machine, No. 20, from charcoal-made pig has made 10*l.* 4*s.* to 10*l.* 8*s.* per ton; mixed ditto, 9*l.* 12*s.*; and coke made ditto, 8*l.* 16*s.* per ton. Hammered iron has brought 9*l.* 12*s.* per ton; and axles, 10*l.* per ton. Affairs are almost *nil* in castings; stocks, however, are very small, since producers have still many orders to execute. A great meeting of the metallurgical interest has taken place at St. Dizier, under the presidency of the Baron de Lesperut, deputy to the Corps Legislatif. There were present at this meeting a rather considerable number of the colleagues of M. de Lesperut. Four speeches were made—or, as the French have it, pronounced. The first of these speeches was by M. Rozier, president of the St. Dizier Chamber of Commerce; another was by M. Stanislas Simon; a third by M. André, on the Parisian octrois; and the fourth by M. Ponyer-Quertier. It would occupy too much space to reproduce these speeches in their entirety; we must content ourselves with saying that they referred principally to the alleged violation of a law of 1836 with reference to temporary imports by means of warrants, which by permitting an importation of Swedish iron into France has compelled forgemasters applying themselves to the manufacture of charcoal-made iron to discontinue their refining works. The meeting denounced the recently concluded treaties of commerce, and called for a system by which customs duties should be voted by the representatives of the country. The meeting also urged the importance of suppressing traffic in warrants, and solicited an application of the octroi duties to iron for building purposes made in Paris, or better still, a suppression of the duties as regards every description of iron wherever produced. Fourthly, the meeting proposed the purchase of such canals as do not already belong to the State, a suppression of navigation duties on canals and rivers, a uniform draught of water, and a simultaneous period of stoppages of navigations, the times selected to be those generally considered least prejudicial to commerce. Still farther, the meeting solicited the completion and improvement of navigable communications, the creation of lines of local interest, and the construction of new canals recognised as necessary, and especially of a canal intended to unite the river of the Oise to that of the Aisne. Finally, the meeting asked for a parliamentary enquiry, which it urged would enable industrials to prove the absolute necessity of the measures forming the subject of the resolutions adopted. Pig continues to be supported with firmness in the Meuse and the Moselle. It is stated that a fusion of the concessions of the Moselle (those of Stiring-Wendel excepted) is on the eve of being authorised by the Government. This piece of intelligence requires, however, confirmation. It is also stated that the French Council of State is occupied with a proposed decree which would modify the rate and regulations of the Parisian octroi duties. The imports of pig and castings, and also of iron and steel plates into France, appear to have considerably increased last year; the increase arose, however, wholly under warrants.

The Royal School of Mines, Jermyn Street.

MR. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE XV.—The methods described in the last lecture as those by which some of the most important and deepest bore-holes of Europe have been put down are of the same description as those of America, which are employed partly to gain access to petroleum and brine springs, and partly for the supply of water, a matter not only of vital consequence to the health of great cities, but to rising communities in new countries, where the saving even of a few thousands in obtaining a convenient water supply may be of great importance. The contrivances already mentioned have been called forth by the necessities arising out of great lengths of rod, and the great weights to be lifted. In the case of bore-holes of large diameter, steam-power has to be employed in various ways, and the skill and advantage with which this has been done at the bore-holes now going on in Paris are worthy of great admiration. We have seen when rigid rods are used a great deal of time is occupied in withdrawing the tool and lowering it again, and that out of 24 hours 8 hours at least would be so occupied; but I have not mentioned that one scheme to lessen the time occupied is the lowering of the clearing tool by a rope. There is what may be termed a sort of suction at the bottom of the bore-hole, which draws with considerable power even at moderate depths, and at lower depths the strain on the rope is much greater. Some borers, therefore, prefer to clear by means of the rods. When, however, we consider the whole operation of boring, the difference between ropes and rigid rods is important. We had very little notion in Europe what could be done with ropes until certain missionaries returning to France from China stated that that remarkable people were in the habit of boring to depths as great as 3000 ft. from the surface. The matter was brought before the French Institute, and eventually the fact was established that these great depths had been attained by the Chinese by the use of a cutting tool simply fastened at the end of a rope, and worked by a lever apparatus. The principal reason why the story was at first discredited was because it was believed that the torsion of the rope would prevent the perpendicularity of the hole from being maintained. This, however, did not deter experimenters from giving it a trial, and at a boring in the chalk deposits near Rheims the rope was used with remarkable economy. In the first place, the manual or horse labour required was less; and, secondly, when the boring tool had to be removed it was rapidly withdrawn by means of a windlass, and was also lowered again at the same rate. Besides this, they employed a borer, which was also a clearing tool; for the cutting edge being placed on a cylinder 3 or 4 ft. in length, in which the material cut away collected, and so emptying the hole was attained by the single operation of drawing out the cutter. The rapidity thus gained enabled them to bore through a strong chalk rock at the rate of from 25 to 30 ft. a day, and the expense was lessened 75 per cent. In England, Mather and Platt, of Manchester, manufacture a flat rope for boring as well as drawing purposes, and thereby escape a certain amount of the torsion which with the round rope is inevitable, and they have also a contrivance by which the turn of the tool is given in a regular manner. The great objection, however, to the rope is that in boring it is apt to get out of the perpendicular, and if an accident happens they are reduced to such straits that it is necessary to introduce the system of rods. Those who prefer the rope, stick with great pertinacity to their own system, but with works of great importance, like those of the Paris borings, it is not thought desirable to introduce the system of rope boring. The deepest borings known out of China have been done by rods, and those at St. Louis and at Louisville, which have reached a depth of 2000 ft., were also sunk by the same means. The Americans in boring for petroleum springs also use rods. It is true that in some cases rope boring may have succeeded, but there are more in which it has failed, and the bore-hole has been lost. That is to say, the rope has broken, and all attempts to extricate the cutter have been failures. On the other hand, rope boring is comparatively so cheap that if two holes can be put down for the price of one it may be worth while to run the risk of losing one of them. In all cases the very best materials should be used.

Whether the system of boring by rope or otherwise be employed, the bore-hole must be lined with tubing, either of metal or wood. In most of the older borings now in existence the tubing is of wood, a material which has many advantages, but which requires a considerable thickness, and thus diminishes the diameter of the bore-hole, a matter of importance if it be sunk to obtain a supply of water. For resistance to mineral corrosives, and for durability, nothing is better than old oak, tubes of which sunk hundreds of years ago are now quite sound, excepting only the upper pieces, which require replacing occasionally. Far different is the case with wrought or cast-iron, which are subject in some waters to rapid corrosion. Zinc and copper are much better, but the latter is generally put in too thin. Zinc is found to resist the action of sulphurous water better than iron would do, but at the present day the general impression is in favour of wrought-iron. These tubes are put down in lengths of 9 feet, 10 ft., or 12 ft., and jointed together by various means. One way is to make the upper end rather larger than the lower, so that the latter may fit into the former. Another plan is to bring them together end to end, and a collar or ring of wrought iron is put over them and rivetted on to both. The tubes are introduced by their own weight, and, if everything is as it should be, will go one on to another down to a considerable depth—sometimes to hundreds of feet—without sticking fast. The plan adopted when that takes place is to place planks across at the top, and weight them with pigs of lead or iron, and by moving them first a little backward, and then a little forward, ease the tubing down. If the pipes stick firm, and cannot be moved, there is nothing for it but to introduce a smaller system of tubing. After a time, perhaps, piping No. 2 may stick fast, and then a third lining must be put down within No. 2. This looks like a great waste of lining material, and particularly if it should have been constructed of the best boiler-plate iron, and fastened together with rivets; besides which the diminished diameter would, in the case of a supply of water being sought, make the bore-hole of much less value. In all these operations, however, everything depends upon the skill and knowledge which the borer brings to bear upon the work. At the present deep and wide bore-hole at the north side of Paris they have had to put in three linings, and the diameter is now brought to 4 ft. 6 in. One of the most remarkable instances of the difficulties attending these operations triumphantly surmounted occurred at the well of Passy, also near Paris, which everyone interested in mining and engineering ought to go and see, even if it were only to witness the water coming up from the bowels of the earth at so high a temperature as to throw off steam. There was another boremaster before Mr. Kind was admitted to take a part in it, and by whose management the work was brought to its termination. The French Government sent to our Exhibition, in 1862, a most instructive model, showing the different modes of tubing, one after the other, which were put down. The result has not, however, been very satisfactory, since the bore-hole, which when first completed passed a large amount of water, now gives out a greatly diminished supply, in all probability from defects in the lining. Two or three things have gone wrong with it, and especially the supply of water from it being less than it was expected to be, which has made it necessary to commence those new operations going on north and south of Paris.

The expense of boring naturally varies according to the nature of the ground to be pierced. In many districts it is usual for a person to keep a set of boring-rods, and undertake the work when required by owners of minerals or mine agents; but in large affairs the master borer contracts to put down a hole of such or such dimensions at a given price, and there is, in fact, a regular tariff for such work. Thus, in the Newcastle district, a few years ago, the first five fathoms would be charged 7*s.* 6*d.* per fathom, the next five 15*s.*, the next 22*s.* 6*d.*, and so on, increasing 7*s.* 6*d.* per fathom in fives until the depth of 100 fathoms is reached, when special bargains are made. Thus, the increasing depth increases the cost in a ratio which makes the operation very expensive. This kind of tariff, however, must not be considered as invariably conclusive, as the borers always expect extra pay when they come to what they call "whin," a name they give to any exceptionally hard stone. Indeed, I have known cases where, instead of a few shillings per foot, boring has cost as much as 6*l.* or 8*l.*, and in one instance from 10*l.* to 12*l.* per foot, until at length that particular bore-hole had to be stopped, on account of its enormous expense. A new era has, however, opened upon boring, which will doubtless come into more general use for shafts, instead of sinking them as at present. The work can go on as well or better when the hole is full of water, and no pumping engines are required to raise large bodies of water, and no expensive, or at least troublesome, arrangements for the security of the men at work at the bottom, and for ventilation. Some of the first attempts of this nature were made by Messrs. Kind. Their improved tools were contrived to cut away the circumference, and enlarge the diameter to 14 ft. or 15 ft.; and by their and subsequent inventions the cost is also reduced. The tariff of the Messrs. Kind is something like the following:—Supposing the bore-hole to be 12 inches in diameter, the charge would be 75*s.* per metre up to 150 metres (a metre being 3·28 feet English); 125*s.* per metre from 150 to 400 metres; 8*l.* per metre from 400 to 500 metres; and beyond that 12*l.* per metre.

LECTURE XVI.—Having now dealt with the subject of carrying out trials by means of boring where we may hope by the expenditure of a comparatively small sum to obtaining useful information as to the character of the minerals below the surface, and having also seen that this apparatus of boring may be brought into action during subsidiary operations in actual mining, we are brought face to face with the forms mining excavations must assume. To day, then, we will devote our time to some of the principal considerations of what has to be done in the trial of ground on a large scale by shafts and levels, and then the means to be adopted to maintain as constant a supply as possible of the useful minerals, with the proper amount of progress in laying open fresh ground for days to come. For this purpose it is necessary to institute a sort of comparison between the workings of a lode and those intended for a stratified deposit, to say nothing of the irregular forms which more or less come under one or other of these categories. If we compare the working of a coal mine, or a stratified ironstone deposit, with the workings of copper, gold, silver, and tin mines, we shall find that although in many points there is great dissimilarity, in others the resemblance is tolerably close. Thus shafts will have to be sunk in both cases, and engines of nearly the same character for pumping out the water will have to be put up. Again, the levels or drifts, or openings, although they do not assume exactly the same forms, have to be supported on similar principles. On the other hand, the different way in which the material to be worked is placed in the crust of the earth causes the principal diversities between the two systems. It is this latter cause which, in one case, gives great facilities for judging at the outset, with considerable accuracy, as to the nature of the output, both in quantity and quality, while in the other case those important points are left in doubt and uncertainty. Thus, metalliferous mines are commenced on a small scale as mere trials, while the workings for stratified minerals will, as a general rule, be commenced with a distinct idea of what the whole operations of the mine will eventually be, it being known what is the distance necessary to descend, and the power of raising a certain quantity being looked forward to as a certainty. In commencing to work a lode small shafts are frequently sunk at inconsiderable distances from each other, and sometimes small levels are driven to test the character of the lode, as well as the ground. Indeed, these shafts may go down as much as 30 or 40 fms. without the miner learning much; and so capricious are these lodes that it is impossible to say from operations of this kind whether it is likely to turn out a profitable mine or not—whether it will yield thousands of tons of ore a year or nothing. No prudent mine manager will, therefore, erect a quantity of machinery at starting, which, indeed, would be requisite if the mine turned out well, but which would be equally likely to be either misplaced or not required. On the other hand, in commencing a colliery or ironstone mine upon a deposit on which there may be no trace at the surface, but of which there is abundant evidence by means of bore-holes, or from other shafts in the neighbourhood, that it exists at a certain depth, and has a particular dip, we know that if we sink in a certain direction we shall find what we want. The mining engineer, then, calculates upon the acreage within the property he has to work, what he can afford to do, what capital he has at his disposal, what amount of output he is likely to be able to dispose of, and then proceeds to put down at once shafts and machinery as large as will be required to work out the whole area. To put down small trial shafts, and to begin in the same experimental way as would be proper in metalliferous mining, would, in the stratified deposits, be mere boggling, and in the end prove more expensive than a large and sufficient expenditure at first. The two problems are very different, and it is in consequence of the want of a proper consideration of this point that in the smaller mines we see so much unsatisfactory machinery and small engines put up, which are found incapable of doing the work when further depths have to be reached, and the operations below become more extensive. When this happens the old machinery has to give place to engines and apparatus of a more powerful character, although occasionally the smaller engines are retained to play a subsidiary part in the general arrangements. These being the facts at the outset, let us now look at the nature of openings below. If we look at a plan of a colliery we shall see that there are two central shafts by which the men descend and pass off to their work, and by which the air is brought down, and, having passed through all the workings, is brought back again to the surface. The plan of a metalliferous mine shows a very different state of things. To get an idea of its workings we cannot take a horizontal plan, as in stratified deposits, but a vertical section, in which we see numerous shafts and levels carried out from them at regular distances.

[The lecturer here referred to a plan of the Lundhill Colliery, and a section of the Levant Mine, each on a very large scale, which were suspended from the wall of rhe theatre.]

The first things that strike us in looking at these is, that whereas a coal mine has no more than two or perhaps three shafts, as a general rule, the metalliferous mine has many. Collieries formerly in a great many instances used to be worked by a single shaft, but upon the occurrence of the frightful accident at the Hartley pit an Act of Parliament was passed making it incumbent on the proprietors to provide a second outlet. Large areas are worked by this means, and as the collieries gradually increase in depth, the cost of shaft sinking is so great that the tendency now is to work as large an area as possible from each pair of pits. Very different is the case with metalliferous mining. In the section of the Levant Mine now before us there are seven shafts within a comparatively short length of ground. Sometimes there are more than there is any actual necessity for, but at the time of sinking there is always some circumstance which seems to render it desirable to make these openings. In driving out the galleries from the shaft a valuable deposit may be found at such a distance that the readiest way to extract it is to sink down upon it instead of making levels from the other shaft. Openings are then made from the shaft one after another at regular intervals by which the engineers learn the general character of the vein they are working. These levels are connected by underground shafts, usually called "winzes" in the South, and "sumps" in the North. These, however, must not be confounded with the well at the bottom of the pumping-shaft, where the water is collected, and which is also called a "sump." The reason for sinking these "winzes" are twofold. In the first place, when the end of the level is a considerable distance from the main shaft the air machine will not produce a sufficient ventilation, and then it is necessary to make a communication with the level above. In doing this, the men work upwards from the lower and downwards from the upper level until they meet midway, and complete the communication. In the second place, this will be a fresh exploration of ground. When a piece of orey ground is reached the miners have a rough, but sufficiently accurate, mode of measuring its value. Taking it as so many fathoms in height, and so many in length, the ground is examined, and according to its quality it is reckoned as containing one, two, or three tons to the fathoms. When there are two fathoms to the fathom, it is called "stoping" ground—that is, it may be taken away by stoping. It is on these calculations that mines are said to contain given amounts of valuable ore. In many cases the parts of secondary value are reserved as a sort of *vis viva* which will carry them over an unprofitably part when the men come into dead ground.

This question of dead ground is, unfortunately, one which is continually arising. The orey ground, as I have explained in former lectures, ceases either gradually or suddenly, as the case may be; the level, as a matter of course, is pushed on a little way, but if no signs of ore are discovered, it becomes a question how far they should continue to drive in this poor ground. This is a point on which shareholders are apt to be far too covetous. If they come upon rich ground they are apt to put a pressure upon the managers or captain, and compel him to devote all the strength of the mine to the profitable places, and then, when they come to absolutely poor ground, they are not prepared for the cessation of their dividends. It is, therefore, desirable, whenever it can be done, to keep back a portion of the good ground for a rainy day, instead of going to the pockets of the shareholders for money to carry on the work. A want of forecast of this kind has proved the ruin of many mines. Suppose all the levels get into poor ground at the same time, you will find it difficult, after dividing profits amongst the shareholders, to induce them to open their purses for fresh calls. Having once tasted the sweets of profit, it will be found easier to reserve orey ground for such an emergency than to make fresh calls, and thus the works may proceed until another orey portion is met with, and the mine goes on prosperously. Every mining engineer, then, in view of such a contingency, should be working out dead ground *pari passu* with that which is profitable. If 300 men are employed in a mine, it would be a question incapable of being solved by strict rule where the men should be placed, where they should drive for the purpose of opening the ground to the best advantage, and what proportion should be engaged in stoping the ground for the purposes of sale. Such questions must depend entirely upon the discretion of the mine manager, which will take within its purview the temper of his shareholders, and the past history of the mine, as well as its future chances. Stoping is commenced by putting in a winze, and then removing the whole orey mass. It is a system much used, because small narrow workings are more expensive, whether the ground be orey or dead. The term dead work is synonymous with tutwork, which is simply a corruption of the German "todt-werk." The winze being made, they then take off slice after slice by processes which are much cheaper than driving levels. It is true that the sinking of shafts may now and then pay for themselves, ore enough being found for that purpose; but shafts must go in their proper direction, irrespective of such chances, and profit is, therefore, never looked for in such works. The same thing happens in driving levels, which, when they go through a rich part of a lode, may yield sufficient to pay for their execution before the ground is broken away on a large scale, but profits of this kind bear no proportion to the levels which are wholly dead. If a mine is to maintain even a moderate degree of permanency, something like half the men ought to be employed in prospective ground, and in opening out new levels, with the hope of making fresh discoveries. The levels of the Levant Mine (section referred to) show places where they went through poor ground for many fathoms, but they persevered, and were rewarded by coming to sets of orey ground which last for years. The workings of a mineral vein are like a voyage of discovery, the lode changing its character from hour to hour and from day to day, so that when matters are at the worst appearances may suddenly be put on which may indicate an approaching change for the better, and mining companies are not unreasonably buoyed up with the hope, when the ground is remarkably poor, that they will soon come to orey ground which may last a long time. A case of this kind occurred in the Dolcoath Mine, when, coming to a place where the granite was intersected by a slaty rock, and the lode lost, they pushed boldly through, and came upon a batch of ore of very great value indeed.

There are some considerable differences in the working of stratified deposits. Supposing the area to be dealt with is of moderate size, two pits are sunk near the centre generally of that area. A pair of levels are then run parallel to each other, with cross-cuts, for the purpose of ventilation, and from that drifts (in pairs, for the same reason) are driven to open out the ground. They may commence at once to work near the bottom of the pits, and send coal to bank, while, at the same time, the exploratory drifts are advancing on the rise of the coal. A better system, where there is capital, is to drive at once to the boundary of the area, and then, beginning at the further extremity, to remove the mineral, backing, as it were, towards the shaft. The great advantage of this plan is that the roof is let down, and the exhausted portions or waste are completely shut off from the workings.

[The lecturer then at great length described the various modes of mapping and colouring, so as to show the workings which are usually adopted, particularly extolling some of the foreign systems, which ingeniously exhibit all the veins of a district, no matter how numerous and intricate they may be.]

FOREIGN MINES.

FRONTINO AND BOLIVIA.—The directors have received from Mr. Rouch the usual advices from the mines, accompanied by a remittance of 474½ ounces of gold dust, the produce for the month of October last. This remittance is less than that of last month, owing to the several causes referred to in the agent's reports. The loss on the month's operations was 22*l.* 19*s.* 6*d.* Mr. Greiff, in his report on the Bolivia Mines for October, states that the rainy season commenced in the last days of September, when violent and heavy showers, which have prevailed to the present day, and which, instead of being of service to the stamp-mills and the progress of the workings at the mines, have been entirely contrary to our wishes, occasioning damages on the water-courses and open-cast workings, difficulties and delay in the carriage of the ores to the mills, and a considerable loss of the softer and frequently richer parts of the ores. All the workings have suffered a sensible loss of time, and the expenses for the new works have increased considerably. The report from the agent at Frontino states that the produce for the past month is 973 castellanos, which I now forward to Messrs. Restrepo and Son. The mill has worked very little for want of mineral, the lode in the main level continuing much the same as when last reported on.

UNITED MEXICAN.—Guanaxuato, Nov. 22: Mine of Jesus Maria y Jose: By the present conveyance I have to report a decline in the produce of the Jesus Maria workings, the hacienda ore having been less in quantity and quality. We are at work in the planes (deepest workings) and on our reserves; on the latter with all due caution, to avoid accidents. In the Santa Librada buscon workings the ore also has declined in ley, and our sales have come down in consequence thereof. The sales were on Nov. 4 $1658, on the 11th $2241, and on the 18th $2179. The accounts for October show a loss of $3637, part of which will, however, be made up by the gold from the ores ground, which will come into the account of December when the raspa from Dolores is introduced.—Mine of Remedios: This mine has continued to be worked much in the same state as last month; the ore does not make northwards along the vein, but we are following it upwards, and the frente de San Cristobal is advancing towards the section of the mine from which we extracted the good ore below in San Joaquin and San Eligio, and I am glad to say that we are in ore about a vara broad, which looks promising. From San Cristobal we have also carried down a pozo to communicate with San Joaquin, which will serve us as a road for a more economical extraction of ore to the upper shaft of San Ignacio. The sales since my last have been—on Nov. 4 $904, on the 11th $926, and on the 18th $918. For October the mine account shows a profit of $4753, of which $2772 is the company's share. The mouth of the mine is gradually approaching our workings from the Jesus Maria lode, and when communicated will give us good ventilation, and relieve us of a very serious expense.—New Concern, Adit of San Cayetano: The adit is being carried on as fast as circumstances will permit. In October we advanced 7¾ varas. The total length reached on Oct. 30 was 563 varas.—Mine of Buenos Ayres: The rock in this mine is more compact than in former months, and we have reached 114½ metres from the beginning of November we traversed two inconsiderable veins of quartz rock without silver in them.—Mine of San Antonio de la Ovejera: In this section of this mine the rock has been extremely hard, and we have made less progress than usual. On Nov. 22 we had reached 144¾ metres.

NEVADA (Land and Mining).—The following is extracted from a letter just to hand from the manager, dated Dec. 9:—"I have written down the produce for November at $12,657·45; it is in reality some $2000 more, but the bullion taken out the last of the month I have not yet got returns from. The total product since starting on Nov. 3, up to to-night, is a trifle over $20,000. I have made no regular clean up, and cannot give cost of working, as to stop to do so would entail a loss of not less than $500. I think I shall make a complete clean up the last of this month. Our works are attracting a great deal of attention from all parts of the coast; parties are here from far distant Colorado and Arizono to examine them." The board have also received a telegram, dated Dec. 25, which mentions the bullion product as $27,000. The board understand this to mean the product for the whole period since the mill recommenced working, on Nov. 3—say, 50 days.

GUERRERO.—By the West India Mail, just arrived, the directors have the following intelligence from Mr. Petherick, the chief superintendent of the company's mines:—"Mineral d'Alvarez, Guerrero, Mexico, Nov. 20: The rainy season has at length subsided, and the company's works are being, and will be, carried on with much rapidity. I have had a good road made from Patambo to Mineral d'Alvarez; enclosed a couple of acres, and collected sufficient materials to go on steadily with the erection of necessary buildings, and the construction of such appliances as the nature of the ground will appear most to require, for the extraction of gold. The survey of the pertenencia is being proceeded with, and I am at present concentrating all my mining strength, on the exploration of ground in the immediate vicinity of the future Puebla. The most interesting point of operation at present is on the Arroga del Tulle, close to head-quarters; here some of the purest gold the working men have collected by hand-washing, under my supervision, has been obtained. These gullies have been the resort of gold seekers for many years, but all of them appear to have mistaken a kind of volcanic conglomerate, which covers the beds and banks of the creeks, for the bed rock, and have only washed the gravel above, and resting on this hard cemented formation. In a few days I shall have penetrated to the real bottom in three or four different places, and from the appearance of the gravel in sinking, I am led to hope for some important discoveries. I have in hand about 1 lb. weight of gold collected by the peones in wooden bowls, which I shall forward to Mr. Potts for transmission to England by first opportunity. I am now preparing tents, &c., for a regular exploring party, who will start in about five days to examine that portion of the Sierra intersected by the boundary line extending from the Cerro Diamante to the River Terretaro, where I am informed some good veins exist in the mountains." They think that from the above advices there is not the least doubt that before long considerable returns will be made by Mr. Petherick.

RHENISH CONSOLS.—G. Sweet, Dec. 30: Christiania: The cross-cut driving south in the 30 is in 3·2 lachters from the shaft; the end is affording more quartz than it has been, with occasional spots of lead, but no sign of the footwall of the lode. A stope in the roof of the 20, east of cross-cut, will also afford 1½ ton per lachter. A stope 8 lachters west of cross-cut will also afford 1½ ton per lachter. A stope 15 lachters west of cross cut will afford 1½ ton per lachter.—Bliebach: The lode in the sink under the 10, on the middle lode will afford 1½ ton of lead ore per lachter. Nos. 1 and 2 stopes, in the roof of this level, will each afford 1½ ton of lead ore per lachter. Now the winze sunk below the adit level, on the north lode, is holed to the rise from the 10 the driving of the western end will be resumed, and stopes set from the winze. The tribute bargains are affording a fair quantity of ore. Through the severity of the frost our dressing operations have been greatly retarded, but we have so far been able to keep Christiania wheel working for pumping purposes.—Estimated Return for December Month: Lead ores, 500 centners, 1400 thalers; total cost on mines, exclusive of block, 1410 thrs.=10 thrs. Block, 70 thrs.—Madonna: The water is again drained to the bottom of Sweet's shaft, and the 7-in. pump keeps it under very easily. As the present depth of the shaft is but little below the old workings, we think it better to sink the shaft deeper before making any workings on the lode, which will be carried out forthwith.—Estimated cost for December Month, including new pump, 325 thrs.; lead ores, 40 centners, 130 thrs.; deficit, 195 thrs.

PESTARENA (Gold).—T. Roberts, J. Mitchell, T. Warne, Jan. 2: We melted the gold ending Dec., 1869, yesterday, and consigned it to-day to Sig. Franzi, 5 ingots, weighing together 336 ozs. 9 dwts. 1 gr. From Pestarena Mines we amalgamated in the past month—at Pestarena, 131 tons of ore, which gave 103 ozs. 19 dwts. 8 grs.; and at Battiglo 41 tons of more inferior ore from these mines, that gave 27 ozs. 2 dwts. 6 grs.; and from Val Toppa Mine 316 tons, which yielded 214 ozs. 7 dwts. 11 grs. The past month has been the most severe for our operations that we have so far experienced in Italy, and with all our endeavours it was not possible to bring ore from the mines to the establishments to supply the mills, the constant falls of snow stopping the carriage of the ore, our greatest impediment. Since the last fall, which took place on the 23d, we have had a great force employed clearing away the snow from the road, and calculated to commence carriage of ore from Val Toppa to-morrow, but, beyond all expectation, it commenced snowing again to-day. The carriage of ore from Pestarena to the rope station, and over the ropes on to Crippi Marelli, has been worked as the weather permitted, and at each of those stations we have a good stock of ore. Over the road from Crippi Marelli to Battigio was only opened for a few days in the past month. The last fall of snow, which is 2½ feet deep on the road, has not been cleared, the weather being so unsettled the communes have not yet decided to make any attempt to clear the road. At Pestarena the snow is 5 feet deep, and severe frost has set in, making very much against preparing ore for the mills; with a great accumulation of ice in the Unza, we are only able to work 130 small mills. The floating ice in the water-courses interfere also with our pumping and winding machinery. Not much has been done to the new water-course, owing principally to the feast days and cold weather. At Val Toppa the snow is 2 ft. deep, stopping all surface works for the present. To enter No. 3 level we have driven through an avalanche 60 metres. At present we are not able to work any of the small mills in the Marmazza.

MINES.—Val Toppa: On the side lode in No. 3 level we are rising on the junction of a flat and a perpendicular lode; this rise yields 3 tons of ore per fathom, worth 12 dwts. of gold per ton. The stopes on the flat lode yield 8 tons per fm., worth 1¼ ozs. of gold per ton. The winze on the downright or western lode yields 5 tons per fathom, worth 1 oz. per ton. The winze on the flat lode is suspended for the present.—No. 2 Level: The end north of No. 1 cross-cut, on the flat lode, yields 4 tons per fathom, worth 7 dwts. per ton. The winze on the new lode, south of this cross-cut, yields 8 tons per fathom, worth 7 dwts. per ton. No. 1 stopes, in the back of this level, on the flat lode, yield 12 tons per fathom, worth 1 oz. per ton; No. 2 stope 10 tons, worth 9 dwts. per ton; and the end driving south 8 tons, worth 7 dwts. per ton. The lode in the end of Marmo Rosso north has divided into branches, and not to value; during the present month we intend cross-cutting west, with a view to reach the western wall; and in the end south we are cross-cutting east through beautiful strata of rock, to reach a south lode. In the end south, above Marmo Rosso, the ore is divided over strata or a channel composed of lead, slate, veins of quartz, and pyrites, altogether about 6 ft. wide, which we estimate to be worth 8 dwts. of gold per ton. Eighty-five metres north of this end we have set a new cross-cut to drive east from the quartz lode, with a view to reach the Marmo Rosso and new lode. The cross-cut east at No. 2 is in a beautiful rock. In the cross-cut east at No. 4 level we have reached some branches of quartz, carrying a little pyrites, but not to value. The ground in the cross-cut west in No. 5 level continues of a favourable nature.

PESTARENA MINES.—Peschiera: The stopes in bottom of the 75 yield 5 tons of ore per fathom, worth 1¼ oz. of gold per ton; the stope in bottom of the 70, 7 tons, worth 1½ oz. per ton. In this level good progress has been made in widening and lowering the old part of the level to receive launders, and rise the winze in the cross-cut west at the 65. The stopes in back of the 46 yield 3 tons per fathom, worth 15 dwts. per ton. The stopes in bottom of this level 4 tons per fathom, worth 17 dwts. per ton. We are continuing the cross-cut west to whim-shaft, to reach the side lodes. We expect to hole this shaft to the cross-cut this month, being 1 metre more to sink, and shall commence to open the old 46 fm. level north. The stopes in bottom of the 33, on No. 5 lode, yield 5 tons per fathom, worth 15 dwts. per ton, and the stopes in back of the 10, 6 tons, 10 dwts. per ton. The 10 fm. level, south of boundary winze, 1 ton per fathom at 10 dwts. per ton, and the stopes south of this winze, above the 10, 4 tons, worth 17 dwts. per ton.—Aquavite: The stopes in back of the 23 south yield 4 tons per fathom, worth 14 dwts. per ton. The stopes in bottom 5 tons per fathom, at 1 per ton. The end north 6 tons per fathom, at 12 dwts. per ton, and the stope in bottom 4 tons per fathom, worth 18 dwts. per ton. The 33 end south 10 tons per fathom, worth 15 dwts. per ton. The stopes in back 4 tons per fathom, at 1¼ oz. per ton. The winze sinking at this level 6 tons per fathom, at 15 dwts. per ton. The 46 end south is poor. The stopes in bottom of this level yield 6 tons per fathom, worth 1½ oz. of gold per ton.

Jan. 3.—G. Franzi: 335 ozs. of gold for December. Snow and frost continue.

AUSTRALIAN UNITED (GOLD).—The directors received on Monday the following telegram from Mr. Kitto, dated Galle, Dec. 27:—"Good reef in bottom level; everything right. See letter."

[For remainder of Foreign Mines see to day's Journal.]

PUMPING MACHINERY.—Mr. Davies Trebilcock, of Lanner, Redruth, writes—By a notice under the heading "Hayle Engineering works of Messrs. Harvey and Co.," I see there is an order for some pumping machinery for the Cerro de Pasco Mines, in Peru. For aught I know, I may be the only survivor of a party of 50 persons who sailed for Peru in 1825, with a view of working those mines, but were unable to do so through the failure of Mr. Richard Trevithick, of Hayle, to work the steam-engine which he and Captain Richard Hodge, of St. Erth, and two brothers called Saunders, and a man named Bevan, had put up. The failure originated in the construction of the machinery. It was not calculated to work at an altitude of 12,000 ft., and where the pressure on the column is only about 10 lbs. to the square inch. I not only wish the company every success, but shall be pleased to find the engine now said to be under construction do good duty, and thus, by its action, discover in those once celebrated mines of the Incas the great treasures which I am persuaded yet remain.

Mr. Welburne has returned to England with a concession from the Natal Legislative Council for 3,000,000 acres of land, including "Newcastle" coal fields, and a subsidy of 40,000*l.* per annum, to carry out a project of railway and colonsiation extention in Natal.

The ORINOCO GOLD FIELD.—American advices state that gold has been arriving at the Philadelphi Mint for several months past from a tract of land in the State of Guayana, in the Republic of Venezuela, known as part of the Orinoco gold field, and now owned and worked by Americans, under the title of the Orinoco Exploring and Mining Company. Altogether $114,000 have been sent to the Mint since April last, $50,000 of which was the product of 58 days' work of one mill running 20 stamps. In addition to the quartz veins there is placer gold also, a specimen of which, analised in a private laboratory in Philadelphia, yielded 93 1-16th per cent. gold and 3 1-16th per cent. silver, the rest being iron and copper. It appears that these deposits have never been worked, and that there is not known to have been any exploration of them from the time of the expedition of Sir Walter Raleigh down to the year 1865, when they attracted the attention of the present owners.

London: Printed by RICHARD MIDDLETON, and published by HENRY ENGLISH (the proprietors), at their offices, 26, FLEET STREET, E.C., where all communications are requested to be addressed.—*Jan.* 8, 1870.